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FINAL TECHNICAL REPORT

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PLANETARY GEOLOGY AND GEOPHYSICS

MARTIAN SEDIMENTARY DEPOSITS

PRINCIPAL INVESTIGATOR:

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INTRODUCTION

The presence of various valley systems has emerged as a strong argument for flowing water on the surface of the planet. Few, if any, fluvial systems appear to have long duration--some are extremely short-lived or catastrophic. Most drainages have not reached equilibrium or graded conditions. Consequent drainages, such as these, form on essentially pristine surfaces unaffected by previous episodes of fluvial erosion. Water flowing across such a surface is trapped in local depressions. The resulting impoundments exists until the depression is filled to overflowing and drainage channels are cut on the downstream side to empty the impoundment, or, if there was insufficient water to overfill the depression, the water will stand as a lake until it was lost by infiltration or evaporation. Natural sites of deposition in such systems include locales of decreased velocity and/or turbulence within the channel, places of impoundment, and cessation of flow at the terminus of distributary systems.

OBJECTIVES:

This study had as its objectives to characterization flow through outflow channels, sedimentation associated with martian outflow systems, and documentation of martian lakes. Over the period of the grant much, but not all, of the study centred on the Maja Valles outflow. Maja served as at example in which the effects of multiple channel routing and ponding could be studied. Maja Valles also served as the test case for calculating flow through an outflow system. Applying the lessons learned in Maja Valles and comparisons and contrast required a scrutiny of other channels.

ACCOMPLISHMENTS:

During the course of this study two initiatives became the chief focus of investigation. The first was developing an understanding of the controls of flow through a martian outflow system using Maja Valles as the primary example (De Hon, 1987; 1990; De Hon and Pani, 1991). The culmination of the studies in Maja Valles is the application of routing and flow history to the system in which hydrographs were constructed for various points along the system, and lag times in basins were calculated to produce an estimate of the duration of the flow (De Hon and Pani, 1992).

Early studies centered on the effects of multiple channel routing in anastomosing systems and ponding along the flow route on discharge at the terminus (De Hon, 1989).

The flood peak is broadened slightly by flow through anastomosing channels, and the crest broadened or even separated into surges by lag in ponds along different routes traversed by the flood. Lag times introduced by ponding along the outflow path result in a prolonged discharge near the terminus of the channel system. A relatively simple history of discharge from the source is translated into a much more complex history at the terminus.

The second initiative was to develop a classification of martian lake basins using planet-wide examples (De Hon, 1987; 1988; 1989). The culmination of the lake studies is a classification of lake basins based on location in relationship to the water source and a beginning base of criteria for recognition of lacustrine plains as opposed to volcanic surfaces (De Hon, 1991). Ponding sites may be classified according to whether they occurred at the head of outflow systems (valley head basins), along the channel (intravalley basins), at the termination of channels (valley terminal basins), or isolated basins.

Most lacustrine basins exist as topographic depressions (craters or other closed depressions) along consequent outflows (De Hon, 1988). They received an influx of water because they were located along the path of catastrophic discharge (intravalley basins and terminal basins). Some, such as valley-head basins and isolated basins, must have been supplied by ground water seepage. Location of the

basin in respect to the drainage system will dictate the source of sediment deposited within the basin. Because surface impoundments are common along many of the outflow channels, Sediments in the terminus of the channels can not be assumed to be derived from along the entire length of the channel. Rather, sediments are derived only from that segment of the channel below the last upstream impoundment.

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* Papers presented at national meetings